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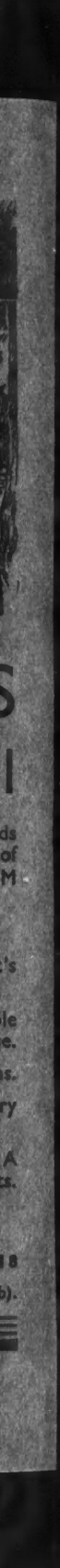

The Bristol Medico-Chirurgical Journal

"Scire est nescire, nisi id me
Scire alius sciret."

SUMMER, 1946.

THE DIAGNOSIS OF TUMOURS OF THE CENTRAL NERVOUS SYSTEM

BY

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THIS paper is concerned with the clinical diagnosis of tumours of the central nervous system: the pure clinical investigation which from long practice has come to include certain of the special methods, ophthalmoscopy, perimetry and lumbar puncture. Although the only true symptom of a tumour of the central nervous system is progressive loss of neurological function, gradual and of varying pace, it is well to remember that signs may be produced not only by invasion and indentation but also by focal or general anaemia, by abnormalities in the cerebro-spinal fluid circulation, and by shifts of the neuraxis with resultant pressure by bone, dural septa or stretched vessels.

The taking of the history is as important as it is difficult and time-consuming. It is a duty which pays high dividends, not only because the chronology of symptoms may provide the only clue to successful localization, but also because it captures the confidence of patients and relatives, so essential to success in treatment. Given a sound knowledge of medicine and pathology, the experience and patience necessary in the elicitation of useful information—and judgment in the acceptance or rejection of statements—it is possible in a large number of cases to make a provisional diagnosis on the history alone and, as it were, to direct future operations from that base.

The physical examination begins whilst we are interrogating the patient, in an assessment of his general condition, his mental attributes and his emotional stability, and in the observation of abnormalities of growth such as occur in craniopharyngeal tumours and in pituitary and pineal disorders. It proceeds to a thorough general examination designed to eliminate the presence of disease elsewhere likely to prejudice the outcome of a major operation or to be mistaken for a tumour. Amongst the latter are syphilis, arteriosclerosis, hypertension and renal disease, and, less commonly, hypoglycaemia, Alzheimer's disease and certain diseases of the blood. Examination of the skin may reveal abnormalities of texture and hair-distribution in pituitary and pineal disturbances, the *café-au-lait* patches or neurofibromata of von Recklinghausen's disease known to be associated with certain intracranial and spinal tumours, and the facial naevi found with certain vascular tumours of the brain. Since metastatic cerebral tumours are fairly common in the middle-aged, the rapid development of the symptoms of an infiltrating tumour or of multiple tumours of the brain (sometimes before the primary has given any sign) should cause a careful search for a primary or for the scar of an operation undertaken earlier for its removal.

There is no need for me to stress the importance of systematic examination of the central nervous system, beginning with all the cranial nerves and including the determination of visual acuity, the mapping out of the visual fields using test objects of several sizes, and the examination of the fundi for optic atrophy, papilloedema, or angiomata. In addition olfactory, auditory and vestibular tests and examination of the vocal cords should be carried out if the history suggests that they are indicated. Motor functions are investigated by noting muscular wasting or fibrillation, by observations on the posture, tone, power and co-ordination of the limbs and trunk, and by scrutinizing the position of the patient's head, his stance and his gait. Sensory functions are tested by cotton-wool, pin-prick, and appreciation of posture : abnormalities of any of these call for a more extensive examination. With the recording of the superficial and deep reflexes the neurological examination is at an end.

At this stage I usually examine the head, paying particular attention to its enlargement in the young, to areas of tenderness or of localized thinning or thickening of the bones. Dilatation of the veins of the upper lid is common in frontal tumours : localized enlargement of vessels on the shaven scalp may be of importance in diagnosis and in planning operation. Lastly, the skull should be auscultated for a bruit and its site of greatest intensity noted. Neurological examination should be repeated, for signs differ on successive days : following lumbar puncture their elicitation may be easier. In a confused or drowsy patient signs may only be unmasked after dehydration by rectal infusions or intravenous injections. Lumbar puncture on patients suffering from an intracranial

tumour should be practised with discretion : in those exhibiting the symptoms or signs suggestive of a serious rise of intracranial pressure, it is absolutely contra-indicated, at least until the threshold of operation ; and even then the amount withdrawn should be no more than 2-3 c.cm. Its use in cases of suspected spinal cord tumour includes manometric observations. Pathological examination of the cerebro-spinal fluid is outside the scope of my subject.

TUMOURS OF THE SPINAL CORD

Of the tumours affecting the spinal cord, 75 per cent. are benign : in the whole realm of surgery there are no better results than those obtained by their removal, provided the diagnosis is made soon enough. Those arising in the cord or its membrane are described as extra- or intradural, the latter group being subdivided into intramedullary and extramedullary. The onset of symptoms is usually gradual and dependent on the location of the tumour both as regards level and relationship to the cord, on the direction of growth of the tumour, and not a little on the mobility of the cord in movements of the spine and in forced expiratory activities.

The course of spinal-cord tumours is commonly chronic and progressive : in the life-history there are often but not invariably three phases. The first of these, the stage of involvement of nerve roots, is often absent. It is marked by pain which is characteristic and pathognomonic. It may precede other symptoms by months or years : it may be constant or intermittent, persist in a localized area or radiate. It is lancinating in character, aggravated by coughing, sneezing, lifting or straining, and invariably wakens the patient in the early hours of the morning : it is, indeed, often so severe as to compel him to walk the floor or to sleep sitting up. Many patients claim as their first symptom pain in a distant part of the body. It is, for example, not at all rare for cervical and thoracic cord growths to begin with pain in one or both legs, pain which is radicular neither in character nor in distribution. As a result of occipital, neck, shoulder, chest, back, abdominal or pelvic pain (the last three of which commonly persist for years before objective motor or sensory disturbances appear), these patients tend to fall into the hands of many physicians, including the psychologist and the gynaecologist.

Paraesthesiae, such as tingling, burning, numbness, pins and needles, and a sensation of cold have been insufficiently stressed as early symptoms. Their location is of considerable importance ; they usually begin first on the side opposite to that on which the tumour is subsequently found at operation. Subjective numbness occurs either as a root symptom, and is then on the same side, or as a result of cord compression, when it is on the side opposite to the tumour. It is perhaps pertinent to note that numbness spreading from the distal to the proximal part of a limb suggests the presence of an extramedullary tumour, whereas the reverse distribution indicates

an intramedullary origin. A sensation of weight or heaviness in the abdomen or limbs is common, but I have the impression that girdle sensations are less frequent than we once supposed. It is only in a very small number of cases of cord tumour that subjective motor disturbances, such as weakness and stiffness, appear before the sensory ones.

The second stage is marked by beginning compression of the cord ; the signs naturally vary with the site of the tumour, and range, at least with extramedullary tumours, from the development of a Brown Séquard syndrome with antero-lateral tumours to ataxia consequent on interference with deep sensation with those situated posteriorly. It is necessary to emphasize that objective sensory disturbances are usually absent in the early stages, although there may be patchy areas of hyperaesthesia to pin-prick, heat and cold. Where several roots are involved, there is distinct diminution or loss of sensation. Later, the amount and extent of sensory disturbance depends on blocking or destruction of fibres in the cord and varies with the site of the tumour. In my experience, dissociation of sensation is more common in extramedullary than in intramedullary tumours, though where it occurs it is necessary to eliminate syringomyelia and haematomyelia as underlying causes. The demonstration of " sacral sparing " is as important in indicating compression of the cord from without as " saddle " anaesthesia is in pointing to a lesion of the cauda equina.

There are no more valuable signs than loss of joint-sense and of appreciation of vibration on the same side as the tumour. When the whole thickness of the cord is involved, these are always disturbed no matter where the tumour originated : the level of the tumour is then suggested by the level of the lowest spinous process at which vibration is felt. Localized tenderness of one or several spines below the tumour is also helpful.

In the early stages of the evolution of a cord tumour, loss of power with diminished tendon-jerks or lost cutaneous reflexes may have localizing significance. Muscle-fibrillation occurs fairly frequently both in wasted muscles and in those not so affected. Gradual compression of the pyramidal tracts results in well-known reflex changes, in increase of tone and diminution or loss of voluntary power below the level of the growth. In extramedullary tumours spasticity and weakness spread from the feet upwards : this never occurs in intramedullary growths, where the motor weakness spreads, as does the sensory disturbance, from centre to periphery.

Decubitus sores are common in cauda equina and conus tumours and in the third and final stage of cord compression, in which paralysis is usually complete, loss of sensation total, and the sphincters without control. The chances of cure by surgery have by now become remote.

I do not propose to discuss the clinical features of tumours at different levels : the diagnosis of the correct level depends on a

careful history and examination followed by a critical survey of disturbed cord functions, be they motor, sensory or reflex.

INTRACRANIAL TUMOURS

It is to be regretted that intracranial tumours are still regarded as rare and hopeless : as a result of this misconception many pass unnoticed, or their victims are denied treatment at a stage when it might well prove effective. Intracranial tumours are in fact amongst the commonest of all diseases of the central nervous system and constitute about 95 per cent. of intracranial space-occupying lesions.

All intracranial tumours are potentially urgent, no matter how mild their symptoms may be when they first come under observation. Grave symptoms may appear suddenly and are often unpredictable.

Before discussing diagnosis, I think it relevant to mention that some years ago Horrax[1] reported that his operative mortality had been reduced to 10-15 per cent. : that 56 per cent. of 400 consecutive tumours were completely and permanently removed, and 71 per cent. of the patients so relieved were leading useful lives with little loss of function.

Intracranial tumours cannot be discussed as a whole for two reasons : there is a great diversity of pathological type as regards histology and mode of growth, and there is a great variety in location. These two factors result in many different symptom-complexes. Broadly speaking, the intracranial tumours most easy to diagnose are the most malignant, and these are not worth touching surgically. The more favourable tumours are often difficult to diagnose, and to determine their presence, let alone their position, may tax all our resources.

It is important to realize that a patient with a brain-tumour may be extremely ill either because he has an unfavourable type of tumour or because a benign tumour has produced a great rise of intracranial pressure. It is clearly essential to decide which of these possibilities obtains in a given case. We therefore find ourselves seeking the answer to three questions : Is there a tumour ? Where is the tumour ? Of what type is the tumour ?

It is convenient to consider the diagnosis of intracranial tumours under the headings general and focal.

General Signs : Time was when headache, vomiting and papilloedema were regarded as the essential criteria of an intracranial tumour. They are in fact indicative of nothing more than a generalized rise of intracranial pressure : and although when a small tumour blocks the cerebro-spinal fluid circulation, for example at the foramina of Monro and in the third or fourth ventricles, they may be the first symptoms, it is dangerous ever to regard them as early.

An intracranial tumour should be suspected whenever without

apparent cause a patient suffers repeated headaches, especially in the morning and increasing in frequency and severity. It should be suspected in children with vomiting increasing in severity and in adults with convulsions.

Drowsiness appears later and is never found in tumours apart from papilloedema, with the possible exception of those involving the hypothalamus. It is unusual for a slowing pulse and respiration and rising blood-pressure to occur with tumours except in the terminal phases.

The headache associated with an intracranial tumour is often characteristic. Bursting in type, it appears at first in the morning, is irregular and transitory, and gradually becomes a daily occurrence of some hours' duration. Later, it appears at other times and is increased by activities causing a rise of intracranial pressure. An expanding lesion within the skull should be suspected whenever there is recurring headache at even longer intervals.

The site of the headache is sometimes, but by no means always, of significance ; temporary relief may be afforded by vomiting which bears no constant relation to food, is often associated with severe nausea, and is commonest in the morning. Vomiting in children, whatever the cause, is apt to be embarrassingly unheralded, so we need not stress unduly its projectile character. Children may make little complaint of headache, perhaps because tumours in them so commonly occur in the posterior fossa and separation of the sutures compensates for a rising intracranial pressure.

Early in the course of papilloedema visual acuity is normal. In fact, the dissociation between the appearance of the discs and the acuity is striking. I underline this point because neglect of ophthalmoscopy is an obvious reason why tumours are overlooked until sight is grossly and often irrevocably damaged ; and also because it is useful in differentiating papilloedema from optic neuritis or retrobulbar neuritis, in which loss of vision is greater than the appearance of the discs would suggest. But absence of papilloedema does not necessarily mean that there is no tumour.

Generalized epilepsy is the first symptom in 18 per cent. of intracranial tumours : it differs in no way from the idiopathic variety and is specially common in slow-growing tumours. Its occurrence is of considerable value in differentiating cerebellar from cerebral lesions, for the seizures are quite different in type. The onset of generalized convulsive attacks after twenty is highly suggestive of an organic cause ; after thirty such cause is nearly always present, and tumour is far and away the most common.

Focal Signs. Little more than sixty years ago Rickman Godlee removed from the right central area a tumour localized on neurological manifestations alone. Since then it has become increasingly possible, in the words of Cushing, " not only to localize a lesion with considerable accuracy, but to foretell its histological character with

reasonable certainty." In the last thirty years, we have seen the clear definition of the pituitary adenomata and the acoustic nerve tumour, the demonstration of visual field defects in temporal and occipital lobe tumours, the lucid description of the features of certain tumours of the cerebellum and of the syndromes associated with the meningiomata, whether occurring on the convexity of the brain or in any of the three cranial fossae.

In the time at my disposal I cannot do more than give an outline —and a sketchy one at that—of clinical localization. I shall begin for historical reasons with tumours of the central area. These are amongst the most easy to recognize because they produce Jacksonian seizures : a careful description of previous attacks and observation by the surgeon of the march of events is indispensible to the proper interpretation of the convulsive phenomena, which depend on the part of the pre-Rolandic gyrus most involved. Examination after a seizure is also required on account of the common occurrence of a post-epileptic paralysis, or Todd's paralysis. This may last for minutes or for hours, and the part most grossly affected affords us a useful clue. With extension of the tumour, there appear the contralateral defects in skilled movements and in the discriminative aspects of sensation, so familiar as to need no further description. Where, however, a tumour extends forward from the post-central area, some confusion may arise from finding paralysis of isolated movements with muscular atrophy and flaccidity in the presence of a positive Babinski if the leg area is involved.

Tumours of the frontal lobe are notoriously difficult to diagnose because the changes they produce can occur as the result of raised pressure from tumours situated elsewhere. If placed sufficiently far back, involvement of the motor, pre-motor and speech areas may break the silence ; but if to the involvement of the area concerned with conjugate eye-movements is added the tremor resulting from partial involvement of the caudate nucleus and basal ganglia, it may be wrongly concluded that the tumour lies in the posterior fossa. Because in anteriorly-placed tumours the signs of raised intracranial pressure are not outspoken, the idea of a tumour may not occur unless the patient has a fit or the doctor an ophthalmoscope. Affairs drag on until too late, that physiological milestone the climacteric bearing the blame for apathy, loss of fastidiousness, defects of memory, personality-changes, and disorders of conduct. Highly suggestive of a frontal lesion is incontinence of urine in a conscious patient. There are two neighbourhood signs of importance ; unilateral or bilateral anosmia (without a nasal cause) and the so-called Foster-Kennedy syndrome, in which there is optic atrophy on the side of the tumour and papilloedema on the opposite side.

Temporal lobe tumours are marked by visual hallucinations, uncinate fits often accompanied by smacking of the lips, upper quadrantic visual loss proceeding to complete hemianopia and

weakness of the face on the opposite side. With medially-placed tumours paresis of the third nerve may occur, and when the dominant hemisphere is affected there is aphasia.

Occipital lobe tumours are uncommon and give rise to visual hallucinations and fits, often beginning with adversive movements of the head and eyes. There is found to be contralateral hemianopia in which macular vision is frequently spared. Extension forwards results in alexia, right-left agnosia, defective powers of calculation, spatial disorientation, and repudiation of the patient's own limbs on the opposite side.

A tumour of the pineal gland is almost certainly present when to the features of a rise of intracranial pressure are added loss of upward movement of the eyes, dilated inactive pupils, and at times absence of convergence. Occasionally there is third-nerve paralysis and gradually progressive loss of hearing.

The shift of emphasis from the endocrine changes to the combination of primary optic atrophy and hemianopia (usually bi-temporal) resulted in pituitary tumours being the first to be clearly defined clinically. These tumours must be diagnosed early not only to save sight, but also because extension beyond the sella results (according to Jefferson[2]) in an operative mortality of 33 per cent. Surgery holds no greater thrill than the recovery or restoration of vision and the filling out of the visual fields after removal of a pituitary tumour.

Mid-line and lateral-lobe tumours of the cerebellum present such distinct and well-known clinical features that I shall pass on to mention the tumours in the cerebello-pontine angle, of which the most common are the acoustic nerve tumours. The first symptom is unilateral deafness usually associated with tinnitus and often with vertigo ; many patients are unaware of the deafness until it is formally demonstrated, and so present themselves with the other two symptoms. The fifth cranial nerve becomes affected next with loss of corneal reflex and facial paraesthesia ; diplopia and weakness of the face follow, to be succeeded by dysarthria and dysphagia ; this first stage of cranial nerve involvement is followed by that of hydrocephalus and at a later stage by the symptoms of pressure on the pons and medulla.

I have of necessity drawn somewhat didactic pictures and am aware that in so doing I have told but part of the truth ; I hope, however, that I have shown that it is possible by accurate deduction to answer at least in part the questions I set myself earlier in this paper. There is a special exultation in occasionally being proved right by subsequent investigation and operative findings : and a stimulating challenge in the more common, if sobering, experience of being wrong.

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[1] Horrax, G. (1943). *Bull. N.Y. Acad. Med.*, vol. 19., p. 125.

[2] Jefferson, G. (1940). *P.R.S.M.*, vol. 33, p. 433.

DIAGNOSIS OF TUMOURS OF THE CENTRAL NERVOUS SYSTEM

BY

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MY part in this discussion is to deal with the accessory methods of diagnosis, but first I feel that I must emphasize the importance of what Miss Beck has so ably claimed for clinical methods. Before using accessory methods the neurologist must assess the clinical picture and the patient. There are certain cases suspected of intracranial tumour in which thorough clinical investigation discloses the true nature of the condition—migraine, aural vertigo, anxiety states and so on : and in such cases the use of accessory methods may be not only unnecessary, but even harmful in heightening the patient's apprehension.

To use accessory methods effectively and in their correct order, the clinical picture must first be studied. In overt tumour syndromes, where there is advanced papilloedema and rise of intracranial pressure, lumbar puncture and ventriculography may be dangerous unless carried out as part of a carefully planned attack, with operation following hard upon the receipt of crucial diagnostic information supplied by the accessory methods. Furthermore, neurosurgery is no exception to the rule that in order to treat a patient satisfactorily it is necessary to know his background and to assess the degree and manner in which he has been disabled by his illness.

Having said so much, one can claim that, used judiciously, accessory methods may add remarkable precision to clinical neurological diagnosis, often revealing the precise situation of a tumour and sometimes providing important evidence as to its nature.

Lumbar puncture. The manometric pressure should always be measured, and, with the patient horizontal and relaxed, should normally be around 150 mm. of cerebrospinal fluid. Rise of pressure above 180 mm. is suspicious of tumour. In certain circumstances the protein content of the C.S.F. is important in pathological diagnosis, for with almost all intracranial tumours which are in contact with the large cerebrospinal spaces—the ventricles and the basal cisterns—the protein content of the C.S.F. is raised above 60 mgm. per cent. In brain-abscess also the protein in the C.S.F. is usually raised and in addition there is usually a moderate increase of the white cells, not necessarily all polymorphonuclears.

In the *surgery of the spinal cord* an advance has been made in recent years from increasing use of lumbar puncture and refinement of the Queckenstedt test, and the more liberal use of spinal radiography with opaque media. Any patient with progressive weakness of the legs should be promptly investigated by lumbar puncture, and, if the Queckenstedt test shows even a partial block, as indicated by slowing of the rise (or fall) of the C.S.F. in the manometer on (or after) jugular compression, there are good grounds for suspecting spinal tumour. In such cases opaque radiography on a tilting table will often reveal the situation of a spinal tumour before there is enough sensory disturbance to indicate the level of the tumour by clinical methods. Spinal tumours are usually benign, and when they can be removed at an early stage, the patient is spared months of incapacity while waiting for the sensory level to develop, and recovery is prompt and usually complete. In spinal radiography the substitution for lipiodol of myodil, which in this country was first made by Professor Wilson Baker at Oxford, has proved of value; for the fluid runs easily in the subarachnoid space, and appears to be quite innocuous.

In conclusion it must be emphasized that successful use of these accessory methods requires expensive apparatus, adequate technical assistance, and a considerable degree of technical skill on the part of the surgeon. The diagnostic precision obtained represents a considerable medical advance.

DIOSCORIDES PHAKAS ON THE DETECTION OF IRON IN BLOOD, URINE AND SPUTUM.

BY

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DURING our visit to St. Félix on the Orinoco, we—my three Venezuelan colleagues and I—were the guests of Dr. McPherson, a general practitioner at St. Félix. His family, Peruvian by origin, had lived in St. Félix for several generations, and he and his father had studied medicine at the ancient Venezuelan University of Merída. Dr. McPherson senior had been interested in the history of medicine and had built up a good general practice. His son, our host, had developed the practice and had also become the Senior Physician of the State Hospital at Upatá, and thus held a well-paid appointment. As he had neither time for nor interest in the history of medicine, he presented to me a bundle of manuscripts, amongst which I found a Latin translation of the twenty-four books by Dioscorides Phakas on medicine, lost since about A.D. 1000. The late Dr. Walter Crum, of Bath, was of opinion that it was written in a seventeenth-century hand. It was copied by Father Jacobus from the original Latin MS. in one of the libraries at Salamanca.

It is well to realise that there were at least three physicians who wrote under the name Dioscorides, namely: Dioscorides Phakas, who was Cleopatra's physician; Dioscorides Pedanios, the author of the famous *Materia Medica*, a contemporary of Nero, Vespasian and Pliny the Elder; and there was also a third Dioscorides, generally known as The Younger, who lived at the time when Hadrian was the Roman Emperor. This Dioscorides made a Latin translation of some of the works of Hippocrates, which was severely criticied by Galen.

Nothing whatever is known as regards Dioscorides, called Phakas because of his freckles, which were distributed like pease (*phakoi*) all over his face. Hirsch[1] translates *phakoi* as "warts," which does not appeal to me: he says that Dioscorides Phakas was a follower of Herophilus who lived about B.C. 300., that his works on medicine were highly praised by Galen (*c.* A.D. 130-200), and that Suidas, who lived about A.D. 970,[2] mentions Dioscorides's works as extant in his exicon. Favrier[3] states that Menodotus, who wrote in the second

century A.D., speaks of the works of Dioscorides Phakas with much respect.

Dr. McPherson senior, in his notes on the manuscript, says that he had found much evidence in Rhazes showing that the latter had made use of Dioscorides Phakas's books on medicine. Historically this is quite probable, as according to Campbell,[4] Rhazes lived *circa* A.D. 841-926, and thus had access to the original Greek manuscript. Le Clerc[5] and Neuberg[6] have already pointed out that Arabic writings are often the best depositories of lost Greek as well as Roman knowledge of medicine. Otherwise all other references to Dioscorides Phakas[7] can be traced to Haeser,[8] who, as will be seen, quite erroneously writes : " After the expulsion of all scholars from Alexandria by Ptolemy Phykon, Laodicea in Syria became the headquarters of the herophilic school. Some well-known physicians learned the art of medicine at Laodicea : namely, Zeuxis, Alexander Philaletus, Heraclides, Dioscorides Phakas . . . "

In his preface Dioscorides gives a brief sketch of his life, and he states that he had studied medicine at Alexandria under Zsosimos.[9] His fellow-students, alphabetically arranged, were Alcamaceonus, Blossius, Claudius, Empedocles, Ephorisius, Epicharmus, Eponymus, Fabius, Hegisippus, Heraclitus, Mercisteus, Pytheus and Xenophanus, all of whom seem to have disappeared into the oblivion of general practice. These names, however, go to show that at the time of Dioscorides, Alexandria still had a flourishing school of medicine, in spite of the bad influence on the city of Ptolemy Phykon. On qualifying, Dioscorides became the assistant of Zsosimos for several years, and he spent altogether ten years in Alexandria. He made the sanatoria his special study, and after having visited several of them he spent over a year at the sanatorium at Epidaurus, of which he writes : " I was much impressed by the good work they did at the Epidaurus Sanatorium, but still more by the sound finance of the place. I have found in Epidaurus what my Queen sent me to find."

Dioscorides was the nephew of Ptolemy XIII and thus a cousin of Cleopatra. The Ptolemaic dynasty was Greek, and his name Dioscorides was obviously not assumed, as was frequently the case with Roman physicians and surgeons. As regards his nickname, Phakas says that it was given him by his fellow students and that Zsosimos often playfully used to call him by this name, He mentions that Zsosimos, during his lectures, when he referred to the opinion held by the ancient Egyptians, but not accepted by Zsosimos, namely, that all that is white in the body is contributed by the father and all that is coloured by the mother, used to say : " Now look at our young friend Phakas, do you expect that any self-respecting mother would sprinkle her child with freckles ? " To which he adds that " this joke used to amuse the others, but I did not care for it."

Until the age of forty-three, Dioscorides held different court

appointments, mainly in the Treasury. His experiences there are reflected throughout his medical works dealing with metabolism, and account also for his dislike of all Aristotelian inexactitudes. Of Aristotle he says : " It would have been a good thing if he had only given his mind to philosophy and avoided medicine."

Dioscorides was in his fifty-seventh year when he returned to Egypt, where he found Cleopatra deep in her intrigues with Rome. Dioscorides's latent xenophobia became acute, and in all his writings he talks of the Romans in Egypt as " those barbarians from the north." How long he was in the service of Cleopatra is difficult to say, but it is doubtful that he survived Cleopatra when she died in 30 B.C.

In a previous communication[10] I traced the early history of the first chemical reagent, namely, Pliny's test for the detection of iron in verdigris,[11] in which Pliny used papyrus soaked in aqueous extracts of galls.[12] Later on I suggested that these observations of Pliny were probably of much older standing and may have originated from the Greek oracles.[13] Oak-leaves soaked in the holy springs[14] would when dry give hieroglyphics which could pass for Greek characters, providing that these springs contained iron, as the veins of oak leaves are rich in tannin. Since then I have had the opportunity of consulting Gruber[15] and found that nearly all the waters in Greece contain iron. Thanks to Dr. Wallis, the Deputy Director of the Bristol Museum, who gave me ancient and modern pieces of papyrus, I was able to confirm Pliny's statement. From the literature at my disposal[16] it was evident that Pliny wrote his *Historia Naturalis* in A.D. 60, which thus dated Pliny's reagent. I further pointed out that Pliny's test is still officially in use in Venezuela[17] and that the vinegar industry[18] in this country still uses it. I now find that it is also the official method in Mexico[19] and that it was used in 1807 as a microscopical test for the detection of tannin[20] in plant-anatomy.

It was this test Dioscorides used a hundred years before Pliny for the detection of iron in blood, urine and sputum, after incineration and extracting both the ash and the galls with rainwater—" heavenly water," as he called it. To understand why Dioscorides made these investigations, we have to realise that his training was Egypto-Alexandrian with a strong Greek bias, which taught that blood from different parts of the human body differs[21] and also that the blood of a man differs from that of animals.[22]

By using this test he convinced himself that this theory is incorrect and then turned to human pathology ; he examined blood-containing sputum in cases of what was probably phthisis, and what he called " bloody urine." He writes as follows : " On one occasion I was preparing a concentrate of goat-blood for one of the ladies of the court who feared that she was pregnant, a great disability, as Cleopatra objects to pregnant ladies at court. I then had a message

from the Queen and after several hours' absence I found that the blood had evaporated to dryness and burned to cinders. I then examined it in the manner described and found that it contained iron. I thus for the first time convinced myself that the goat's blood contained iron. I then turned to human blood and diseases, namely sputum that contained blood, and 'bloody urine.' I found that they all contained iron, and I felt convinced that the belief that the blood of mankind differs from that of the animals is wrong."

Later on he wrote and dated his entry for the first and only time. "To-day my Queen was twenty-five years old [46 B.C.], and I have made a discovery which I find difficult to understand. Several years after I had found iron in 'bloody urine,' I used to leave this urine standing in narrow wine-glasses, but there seemed to be little change in these urines; apparently I was too hasty in wanting to find the truth. One day, for some reason I have forgotten, probably the fact that I was sent for by the Queen, as she always wanted us, whom she trusted, to be present on her birthday, the day the gods sent her to Egypt. Several days later I found that it looked like healthy urine and that it had a divine golden colour. This made me think for many days, because on using papyrus treated with gall-extract in the manner described I found that it contained iron. What it means I do not know. This is a secret only the gods know. Since then I have repeated this as we have much 'bloody urine' in Egypt both in men and women."

It would be rash to say that Dioscorides thus described blackwater fever, as there is no evidence that Egypt in ancient days had either blackwater fever[23] or even malaria.[24] However, Dioscorides's observations are suggestive enough to be compared with the present-day data given by Dukes[25] for the examination of blackwater urines.

Dukes recommends the following procedure for the diagnosis of blackwater fever. Test-tubes filled with urine are observed on standing. On the first day the urine is black and contains methaemoglobin and oxyhaemoglobin. On the second day the urine is dark red, it is in the stage of devervescence, and oxyhaemoglobin predominates. On the third day the urine is brownish and recovery has set in, as there are only traces of methaemoglobin present. Table III by Dukes shows these details very clearly.

Quoting Fairley and Bromfield (1934), Dukes writes that they "consider the haemolytic agent in blackwater fever to be dependent on some metabolic breakdown precipitated by the administration of quinine . . . . The blood corpuscles are first haemolysed and the liberated haemoglobin subsequently converted into methaemoglobin and other pigments which are excreted in the urine." Their observations seem to agree with those made by me[26] where it was found that out of thirteen blackwater urines twelve contained a disintegration product of quinine which had haemolytic properties and was

provisionally named Haemoquinic Acid. However, all malaria urines contained haemoquinic acid after the administration of quinine, with the difference that in cases of blackwater the haemoquinic acid content is 578 times greater than in normal malaria cases. These results lead, in my opinion, to the conclusion that blackwater fever is due to idiosyncrasy in malaria-infected individuals.

Even if one assumes that Egypt in the time of Dioscorides had malaria and thus also blackwater fever, the production of haemoquinic acid from quinine cannot account for his "bloody urine," as quinine was not known until the discovery of America.[27] Dioscorides, in his book on fevers, to be dealt with in a later essay, says: "We have all kinds of fevers; some we know how to treat and of some we have no knowledge whatever. There is a fever which none of us, including our priests, understands, and we do not know how to treat it, unless we use the extract of a herb which comes from far away. Early in the summer of every fourth year a large caravan of 500 to 1,000 camels leaves Egypt, and they are away for three years, when they bring many sacks of this herb, and we all hunger for it. They bring enough to last three years. I have talked to the men and they tell me that it takes a year to get to the place where the plant grows, as they have to climb many mountains. It takes a year to collect the herbs and a year to come back, as many of the camels are lost and a caravan of 1,000 camels is generally reduced to about 700. Also many of the men are killed by the natives of that country, who speak a foreign language, have yellow faces and very little hair on their faces and other parts of their body. That is all I have been able to find out as regards the country from where the herb comes."[28]

[In conclusion I mention that Dr. McPherson desired that the MSS. be presented to me and should be known as the St. Félix Manuscripts.]

REFERENCES AND ANNOTATIONS.

[1] Hirsch: *Biographisches Lexikon der hervorragenden Aerzte*. . . . (6 vols.) Wien and Leipzig, 1885-1888.

[2] Seyffert: *A Dictionary of Classical Antiquities*. Revised and edited with additions by Nettleship and Sandys. London, 1894.

[3] Favier: *Un Médecin Grec du II-ième Siècle A.D.* Paris, 1926.

[4] Campbell: *Arabian Medicine* . . . . (2 vols.) London, 1926.

[5] Le Clerc: *Histoire de la Médecine arabe* (2 vols.) Paris, 1876.

[6] Neuberg: *Geschichte der Medizin*. Stuttgart, 1908.

[7] Haeser: *Lehrbuch der Geschichte der Medicin* (3 vols.), Jena, 1875-1882; and *Geschichte der Chirurgie* . . . , Jena, 1864.

Gurlt: *Geschichte der Chirurgie* . . . (3 vols.) Berlin, 1898.

This error does not occur in Sprengel: *Versuch einer pragmatischen Geschichte der Arzneikunst* (5 vols.), Halle, 1792-1828; and has also not been perpetrated by Allbutt: *The Historical Relations of Medicine and Surgery*, London, 1905; and *Greek Medicine in Rome*, London, 1921.

[8] Haeser: *Grundiss der Geschichte der Medizin*. Jena, 1884.

[9] Zsosimos was a common name and it is therefore difficult to decide who this Zsosimos was. I am, however, inclined to think that he was the Zsosimos who wrote the famous letters to Theosobia, whom from time to time he called " my Queen, Beloved, Sister or Wife," which dealt amongst other things with fermentation ; *see* Berthollet : *Introduction à l'Étude de Chimie des Anciens et du Moyen Age*, Paris, 1889 ; and *Les Origines de l'Alchime*, Paris, 1885 ; Kopp : *Beiträge zur Geschichte der Chemie*, 1869 ; Braunschweig : *Die Alchemie in älterer und neuren Zeit* (2 vols.), Heidelberg, 1886 ; Hopkins : *Alchemie, Child of Greek Philosophie*, Harvard, 1934. Like Zsosimos, Dioscorides is also interested in fermentation, which he applies to digestion (to be dealt with more fully in a subsequent essay giving Dioscorides's work on digestion as compared with Zsosimos's researches on the fermentation of wine and other beverages).

[10] Nierenstein : *Isis*, xvi. 439, 1931.

[11] The origin of the term " verdigris " has been the object of much philological speculation, and it seems to be a corruption of the Anglo-French *Vert de Grèce* (Greek Green) ; *see* Bailey and Bailey : *An Etymological Dictionary of Chemistry and Mineralogy*, London, 1939. Similarly the German *Spanisch Grün* for " Greek Green " is of the same philological origin ; *see* Beckmann : *Beiträge zur Geschichte der Erfindungen* (5 vols.), Leipzig, 1786-1806 ; who points out that it was also known according to Maader : *Teutsche Sprach oder Dictionarium germano-latinum*, Zürich, 1561, as *Spanisch Grün*, which he translates as *viride hispanicum*. Beckmann suggests other origins, and reference should be made to him for further study on the philology of " verdigris."

[12] Pliny : *Historia Naturalis*, xxxiv. 2 ; *see also* Bailey : *The Elder Pliny's Chapters on Chemical Subjects* (2 vols.), London, 1932.

[13] Nierenstein : *The Natural Organic Tannins*. London, 1934.

[14] Gallaeus : *Sibylina Oracula* . . . Amstelodamii, 1789. The large preface by Gallaeus is in itself a monograph of the different Greek as well as Roman modes of divining, and makes most interesting reading.

[15] Gruber : *Die Quellen Griechenlands chymisch, physisch und medizinisch Untersucht* (3 vols.), Weisskirchen, 1756-1773.

[16] Nierenstein : *Analyst*, lxviii. 212. 1943.

[17] *Farmacopea Venozolana*. Carácas, 1928.

[18] Mitchell : *Vinegar : its Manufacture and Examination*. London, 1926.

[19] *Farmacopea Mexicana*. Mexico, 1937.

[20] Baker : *The Discovery of the uses of Colouring Agents in biological Microtechnique*. London, 1945.

[21] Hebrew medicine probably influenced Egyptian medicine. According to Hebrew medicine the blood of man is holy, whereas that of animals is not pure ; *see* Ebstein : *Die Medizin im Neuem Testament und im Talmud*, Stuttgart, 1903 ; Brim : *Medicine in the Bible*, New York, 1936.

[22] For the teaching of the Alexandrian school of medicine consult the easily accessible works of Allbutt, especially his *Greek Medicine in Rome*, where on page 308, referring to Galen's theory that the veins have their roots in the liver, Allbutt adds : " The Chinese to this day, I am told, hold that the right pulse tells the state of the liver, and the left the state of the heart." *See also* Walsh : *Old-Time Makers of Medicine*, New York, 1911. There is no doubt whatever that there was a strong eastern influence on Greek and Egyptian medicine, as evident from Preuss : *Biblisch-talmudische Medizin*, Berlin, 1911 ; Budge : *The Syriac Books of Medicine* (2 vols.), Oxford, 1913 ; Breasted : Introduction in vol. i. of *The Edwin Smith Surgical Papyrus*, Chicago, 1930.

[23] Scott : *History of Tropical Medicine* (2 vols.), London, 1942.

[24] Brim : *Medicine in the Bible* . . ., New York, 1936 ; which I found, however, not to be reliable in many respects, as the author is far too enthusiastic to prove his points. Brim seems not to have been aware of Preuss : *Biblisch-talmudische Medizin*, Berlin, 1911—a remarkably unbiased work. I must confess that I find it very difficult to take seriously Dr. Brim, who speaks of a Mosaic Health Board with " Moses as President and Aaron as Vice-President."

[25] Dukes: *Urine Examination and Clinical Interpretation*, London, 1939.

[26] Nierenstein: *Jour. Royal Army Medical Corps.*, xxxii, 218, 1919; and for the extension of this work see Nierenstein in *Observations on Malaria*, edited by Ross, p.74, London, 1919.

[27] The story of the cinchona bark has been told by many, but I do not know of any more fascinating historical review than that by Flückiger and Hanbury: *Pharmacographia*, pp. 341-348, London, 1879. They make it clear that from a statement by Humboldt (1807): "the Peruvians (Mexicans) would rather die than have recourse to what they consider so dangerous a remedy." I have spent some considerable time amongst the Caroni Indians, who live on the Caroni River, a tributary of the Orinoco, and I hope one day to write more fully of their pharmacy and medicine. I mention, however, that the Caronis, who were fugitives from Mexico long before the Spanish Conquest, still refuse to take quinine, especially the older people. They use the extract of a plant they call *tzompo pachtzi*, identified as *Erythrina corallorida D.C.* by Emmart: *The Badanius Manuscript* . . ., p. 283, Baltimore, 1940. The Caronis know blackwater fever in men and women, and they look upon it as a form of menstruation in both sexes.

[28] The information contained in Dioscorides is too fragmentary to allow any conclusion, but one cannot help but wonder if it does not refer to what is known as *Ch'ang Shan* (*Dichroa febrifuga*), described as an antimalarial by Chang-Shaw Jang: *Chinese Medical Journal*, lxii. 185, 1944. Dichroa, like cinchona, may also be the cause of blackwater in malaria. At the present time too little is known of this plant to allow certain deductions; however, Dioscorides's description of the method by which it was imported is suggestive. In this connection it is interesting to note that Meyer: *Botanische Erläuterungen zu Strabons Geographie* . . ., p.127, Königsberg, 1852, mentions a species of Dichroa which according to Strabo (*c.* 63 B.C.-A.D. 19) was used as an internal antiseptic against fevers in North Africa.

Although at present it is best not to identify Dioscorides's "bloody urine" with blackwater fever, the clinical details of eight cases given by him remind one of the many cases quoted by Stephens: *Blackwater Fever*, Liverpool, 1937. Once historians are agreed, contrary to Scott,[23] that Hippocrates's fourteen cases of "bloody urine" are blackwater fever, Dioscorides becomes the second and Galen the third physician to have described the disease.

INHALATION OF FOOD DURING INJECTION OF PENTOTHAL

BY

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THE accidents described below are of some importance, since pentothal is frequently administered in unfavourable conditions: if not promptly recognized they may prove fatal. During and after the invasion of France it was necessary to administer pentothal to hundreds of patients who had not been prepared and whose stomachs contained food. In four cases food was inhaled during the administration.

Case 1.—After a fourteen hours' session, at 3 a.m., while the last operation was in progress, the dental officer arrived to stitch up the mouth of a concussed and inebriated despatch-rider. There was free bleeding into the mouth: otherwise the man would have been evacuated. He objected to local anaesthesia and became unmanageable, so I was asked to administer pentothal. When 7 c.cm. of a 5 per cent. solution had been injected, respiration ceased and the patient became cyanosed. Without considering that this dose would be unlikely to cause respiratory paralysis, I attempted to inflate the lungs with oxygen. This was not successful, so a laryngoscope was passed and a small piece of food was seen in the pharynx. An intra-tracheal tube was passed, and suction removed more food, but the trachea still remained occluded. Tracheotomy was therefore performed, a tube was passed into the left bronchus, and a piece of onion was sucked out. The lungs were again inflated with oxygen and respiration was re-established. Auscultation shewed that the right bronchus was still blocked, and this in turn was sucked clear. The patient was evacuated next day and his subsequent history is not known.

Case II was similar to Case I except that when respiration ceased I was able to suck the food out of the trachea without performing tracheotomy.

Case III.—Four days after operation for appendicitis, a Dutch officer began to bleed briskly from the wound. He was quickly taken to the theatre; the orderly who brought him stated that the patient had not had his supper. After only a few c.cm of pentothal solution had been injected the patient became cyanosed. A laryngoscope was

passed, and soup was seen in the pharynx and also welling out of the trachea. It was sucked out, respiration was restored, and the bleeding point secured.

Case IV.—This was interesting as the patient had a compound fracture of the femur. He had some tea just after the accident: then travelled from Bourg Leopold in Belgium to Eindhoven in Holland and was brought on the operating table about three and a half hours after the accident. After a few c.cm. of pentothal had been injected the patient became cyanosed, and the tea was found in the trachea. After the operation the patient affirmed that he had had no tea on his arrival in hospital.

The points of importance in these cases are :—

1. There is no sign of vomiting. The food passes up the oesophagus and is then inhaled *quietly* into the trachea.

2. The absence of coughing.

3. As the patient becomes cyanosed quietly one is apt to assume that the cause is depression of the respiratory centre, and so to proceed to inflate the lungs without first establishing that the airway is clear.

4. It is essential to have a laryngoscope and suction apparatus at hand when using pentothal for an unprepared patient. The cause of these accidents was the slowness of the injection of the pentothal. All four of these cases occurred during the time the C.C.S. was receiving numbers of casualties, of which a high proportion were suffering from severe degrees of shock. As I was continually anaesthetizing shocked patients, I developed a habit of giving pentothal very slowly and carefully, as it is well known that the severely wounded man needs a very small dose to take him into the third stage. Now these four patients were not suffering from shock and the injection given slowly did not paralyse the vomiting centre.

After these accidents I never gave an unprepared patient who was not shocked less than 0.75 gm. in 5 per cent. solution, and I gave it quickly. Since then no further cases occurred. Before advising this method one must take great care to estimate the degree of shock. Professor Lundy, in his *Clinical Anaesthesia*, states that a full stomach is a definite contra-indication to the administration of an intravenous anaesthetic. While I agree with this abstention in civilian practice, it was not feasible in war surgery.

Reviews of Books

Demonstrations of Physical Signs in Clinical Surgery. By HAMILTON BAILEY, F.R.C.S. Tenth Edition. Pp. xii.+372. Illustrated. Bristol: John Wright & Sons Ltd. 1946. Price 30s.—A medical book which has run into ten editions in less than twenty years, which has been, or is being translated into seven languages, carries its own commendation. The immediately outstanding value of this, as of the older editions, is due to its lavish display of illustrations. These are well chosen and well displayed, often in colour, and they number 573, nearly two to a page. Nowhere else, as far as we are aware, can one find the like. Nor is it fair to say that the conditions illustrated are so rare that they would never be seen in ordinary practice. But if it is the pictures that catch the eye, the text is equally valuable, thoroughly up to date, and bearing evidence of a wide clinical experience.

Leprosy. By Sir LEONARD ROGERS, K.C.S.I., C.I.E., M.D., F.R.C.P., F.R.C.S., F.R.S., I.M.S., and ERNEST MUIR, C.I.E., M.D., F.R.C.S. Third Edition. Pp. xii.+280. Illustrated. Bristol: John Wright & Sons Ltd. 1946. Price 25s.—This is the third edition of a book which has long since taken its place as the most authoritative work upon the subject in small compass in the English language. This edition will do nothing to lessen the position won by its predecessors. The authors speak out of a long experience with authority but are never dogmatic. The whole field is covered adequately though naturally briefly. The fascinating story of the history of the disease is related in such an interesting manner that the reviewer read every word of it. At first sight he was inclined to think that possibly a little too much space had been allotted to questions of history at the expense of a more detailed description of the treatment, but upon re-reading this section he came to the conclusion that this was an unfair criticism and that the doctor desirous of knowing how to deal with any particular case of leprosy can find here all he need know, and should he desire further information, one very valuable feature of the book is the exhaustive bibliography provided. The illustrations are very good and excellently reproduced. The format is up to the standard we expect of the publishers, and the whole production a credit alike to authors and producers.

Anatomy of the Bronchial Tree. By R. C. BROCK, M.S., F.R.C.S. Pp. vi.+96. Illustrated. London: Oxford University Press (Geoffrey Cumberlege). 1946. Price 42s.—This book is a reprint of articles published in the *Guy's Hospital Reports*. It embodies the results of

very careful and extensive research into the anatomy of the bronchi, with particular reference to the part of the lungs associated with each branch and the surface markings and surgical approach. It is beautifully reproduced, with lavish diagrams (many in colour) and plates showing dissections and X-ray films—in all, more than twice as many illustrations as pages of text. It is certainly a book that every consultant must possess whose work involves the chest.

Textbook of Psychiatry. By D. K. HENDERSON, M.D., F.R.F.P.S., and R. D. GILLESPIE, M.D., D.P.M. Sixth Edition. Pp. 732. Illustrated. London: Oxford University Press. 1944. Price 25s.—Since the first edition of this book was published in 1927, it has remained the most important text-book of psychiatry written and published in England. In this, the latest edition, the lay-out is much the same as before, but in certain details it has been brought up to date and the modern methods of physical treatment are described in some detail. The psycho-pathology remains very much as before: the authors adhere to the biological view point of Adolf Meyer and the teaching of his followers in the American school. The text-book is sound, but students will not find it any easier to read than the previous editions, and perhaps the case-histories could have been shortened and clarified with advantage. The bibliography is probably neither as detailed nor as comprehensive as one would like to see in the principal standard text-book.

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Owing to the great increase in the cost of production, it has become necessary to raise the price of the Journal from Three Shillings to Four Shillings for each issue. Annual subscription, Sixteen Shillings.

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Aitken, R.	*The Problem of Lupus Vulgaris*		(2)	1946
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	(*a*) *Cumulative Supplement*		(4)	1946
	(*b*) *Medical Progress*		(4)	1946
Hueper, W. C.	*Occupational Tumors and Allied Diseases*		(5)	1942
Johnstone, R. W.	*Textbook of Midwifery*	12th Ed.	(2)	1945

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Newman, C.	*Medical Emergencies* 3rd Ed.		1946
Novak, E.	*Textbook of Gynæcology* 2nd Ed.		1944
Osler, W.	*Principles and Practice of Medicine* 15th Ed.	(2)	1944
Paterson, R., Tod, M., and Russell, M.	*Results of Radium and X-ray Therapy in Malignant Disease*	(2)	1946
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Semon, H. C. G., and Moritz, A.	*Atlas of the Commoner Skin Diseases* 3rd Ed.		1946
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Modern Treatment Yearbook		(2)	1945
Quarterly Cumulative Index Medicus. Vol. 38. July to December			1945
Yearbook of the Eye, Ear, Nose and Throat		(2)	1945

Publications Received

From OXFORD UNIVERSITY PRESS:

The Anatomy of the Bronchial Tree. By R. C. BROCK. 1946. Price 42s.

The Nervous Child. By HECTOR CHARLES CAMERON. Fifth Edition. 1946. Price 10s. 6d.

From H. K. LEWIS & CO. LTD.

A Handbook of Radiography. By JOHN A. ROSS. Second Edition. 1946. Price 10s. 6d.

From JOHN WRIGHT & SONS LTD.

An Atlas of the Commoner Skin Diseases. By HENRY C. G. SEMON AND ARNOLD MORITZ. Third Edition. 1946. Price 50s. Net.

Demonstrations of Physical Signs in Clinical Surgery. By HAMILTON BAILEY. Tenth Edition. 1946. Price 30s.

British Journal of Surgery. July, 1946. Price 12s. 6d. Yearly Subscription 42s.

Local Medical Notes

Royal College of Obstetricians and Gynæcologists.—Dr. Mabel Potter.

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University of Bristol.—M.D.—J. J. Kempton.

M.B., CH.B.—*First Examination :* A. M. ApSimon, K. B. Arney, Margaret M. Ashton, Pearl D. Barker-Wyatt, Ann E. Boulter, R. B. Brodie, June M. Butler, Nancy C. C. Carter, G. V. Catford, Jean M. Elliott, V. Gavrilovic, W. E. L. Gordon, M. Gummer, Ann M. Haines, G. J. Hillier, Audrey V. Hooper, Elisabeth Hopkins, R. J. Hunt, R. A. Iles, D. J. A. Jarvis, June P. Lawson, June K. Lloyd, D. G. MacLeod, S. E. Mbanefo, Mary Motton, Ann C. Parry, D. S. Paton, Ruth E. Pawlyn, G. F. Pinckney, Jean M. H. Pinkerton, R. D. Stride, Denovah Vardy.

M.B., CH.B.—*Second Examination :* Rosalind P. Adams, Joan H. Barnes, B. B. Beeson, Joan K. Cheeseman, Jennifer M. Comely, Diana F. J. Duncan, F. V. Eastman, A. R. Ebanks, P. C. Farrant, Katharine E. Fawcus, Elizabeth M. Fraser, D. M. Gambier, Patricia M. Gilbert, J. C. Gregg, Pamela Hawkins, Pamela M. Hellings, G. C. K. Herapath, Sybil E. Jacob, G. Lucas, Ellen M. Marron, J. P. Martin, Elizabeth M. Morgan, Jean Musgrave, P. A. Normandale, Margaret R. Salisbury, H. Schnieden, J. D. Sheward, June M. Smith, Medora Storkey, G. Walters, Olwen J. West, Catherine C. White.

M.B., CH.B.—*Final Examination :* Kathleen Blott, W. H. K. Carpenter, Pamela M. Farmer, H. W. Jones, Florence E. Moore (*a*), H. S. Paull, C. D. R. Pengelly, Dorothy E. M. Pierce, A. D. Stewart, K. D. J. Vowles (*b*). *Section I only :* Patricia M. Appleton, M. J. Dunn, N. G. Glen, W. H. N. Moore, Josephine C. Mulcahy, G. Winternitz.

B.D.S.—*First Examination :* M. Bernstein, A. H. Chivers, M. N. Simmonds, Ruth A. Yearn.

B.D.S.—*Second Examination :* D. C. Berry, J. S. Cooper.

B.D.S.—*Third Examination :* L. M. Lloyd.

B.D.S.—*Final Examination :* G. A. J. Comyn, A. N. R. Gibson, A. F. J. Smith.

L.D.S.—*First Examination :* G. D. Everard.

L.D.S.—*Second Examination :* J. P. B. Pengelly, J. T. Sanders.

L.D.S.—*Third Examination :* M. J. Bartlett, Margaret J. Webb.

L.D.S.—*Final Examination :* L. G. D. Brown, J. C. Nicholas.

(*a*) With Distinction in Obstetrics.

(*b*) With Distinction in Surgery and in Public Health.